

# *Hybrid Poplar Forest Management Plan*



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## OVERVIEW

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### *What can I use this document for?*

This document is intended to provide landowners information about developing a forest management plan for Hybrid Poplar. It contains background information about Hybrid Poplar and biomass, as well as templates that may be used in developing a forest management plan for Hybrid Poplar.

### *What is Hybrid Poplar?<sup>1</sup>*

Poplar is the general term for trees in the genus *Populus*. Thus, poplars include cottonwoods (poplars) and aspens. Most *Populus* species are native to the temperate and colder areas of the northern hemisphere. Hybrids are produced when plants of different species (usually in the same genus) are cross fertilized. This can occur naturally where the geographic distribution of two crossable species overlap. Hybrids are also developed through plant breeding. Hybrids are usually more widely adaptable or tolerant of environmental extremes than the parents.

### *Why Hybrid Poplar?<sup>2</sup>*

Compelling reasons for planting hybrid poplars include rapid growth and ease of vegetative propagation from stem cuttings. On good sites, hybrid poplars grow faster than any other northern temperate region tree. For some products, harvests can be made yearly. Because of quick resprouting, replanting after harvesting may be unnecessary, especially for short harvest cycles.

### *What can Hybrid Poplar be used for?*

#### **Energy**

The primary use discussed for hybrid poplar is as a biomass boiler fuel. Burning wood does not increase atmospheric carbon monoxide (CO). The hybrid poplar absorbs as much CO over its lifetime as is given off in burning so it "mitigates" amount of CO given off. Biomass fuel crops may be purchased by plants or by singular users operating a boiler system.

#### **Pulpwood**

There is an increasing need for aspen for the production of wood products in the Lake States. Hybrid poplar is well-suited for manufacture of quality paper, and may be a substitute for aspen.

#### **Sawlogs**

Hybrid Poplar can be sawn into lumber for use in pallets and furniture stock.

#### **Engineered Lumber Products**

Hybrid poplar can be used in the process of making oriented strand board (OSB) and, possibly, structural lumber.

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<sup>1</sup> Washington State University. To read full webpage: <http://puyallup.wsu.edu/poplar/poplar.html>

<sup>2</sup> Washington State University. To read full webpage: <http://puyallup.wsu.edu/poplar/poplar.html>

## Chip Products

Hybrid poplar chips can be used in landscaping and animal bedding products.

## Conservation & Ornamental Plantings

The desirability of trees for shading and bank protection along streams and rivers is increasingly recognized. The high nitrate uptake and deep rooting of these trees make them good choices for buffer or "filter" planting along streams in agricultural areas in both coastal and inland zones. Nonharvest uses of hybrid poplar also include rapidly growing shade trees, windbreaks and screen plantings.<sup>3</sup>

### *What is Biomass?*

Woody biomass falls under the category of biofuels, which is a general term for converting biological mass into energy – this includes liquid fuels, processed pellets, and combustion of chipped material. Specifically, woody biomass can be obtained from existing forestlands, which is how most of the local demand is being met.

There are more than 8 million acres of forestland in the Upper Peninsula. Currently, only about 1/3 of the productive capacity is harvested every year. This indicates that there is available biomass, but it needs to be determined how to obtain this biomass efficiently and economically. It may be difficult to obtain a consistent amount of this woody biomass due to low harvest rates and their geographic distribution.

If woody biomass is managed, it can produce eight times more biomass annually than native forests and is easier to harvest. It is easier to harvest because it is planted in plantations with consistent and sufficient spacing to accommodate equipment. This plantation planting also reduces contamination of the fuel by reducing non-vegetative material in the shipments. As technology advances, it is likely that equipment will simplify the conversion of woody biomass directly into chipped material.

The changes in the renewable energy mandates are putting additional emphasis on "closed-loop" biomass production. This "closed-loop" system starts with dedicated woody biomass plantations that are planted and managed strictly for biomass energy production<sup>4</sup>.

Hybrid poplar has been categorized as one of the economically feasible tree types to plant on unused agricultural lands in the Western Upper Peninsula, along with willow and switchgrass. Of the three, hybrid poplar would be the most economically feasible. Below is a summary of the three biomass crops<sup>5</sup>:

### Hybrid Poplar

- Long harvest cycle (10 years) makes it a long-term investment
- Positive returns at a yield of greater than 3.3 dry tons/acre/year

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<sup>3</sup> Washington State University. To read full webpage: <http://puyallup.wsu.edu/poplar/poplar.html>

<sup>4</sup> Woods, Roger. 2013 October. U.P. Biofuels Cooperative Strategy. Houghton, MI: Michigan Technological University. 23 p.

<sup>5</sup> WesMin Resource Conservation and Development, Inc. 2003 October. Hybrid Poplar Handbook.

- Initial planting costs require large upfront investment
- Availability of planting technology could be an issue

### **Willow**

- Initial planting costs make this type of crop too expensive to establish
- Planting 6,000 cuttings per acre
- Requires specialized equipment to feasibly do larger plantings
- 3 year harvest cycles provides earlier revenue, but does not have a positive payback

### **Switchgrass**

- Cheaper to establish using traditional farm planting methods
- Harvest on a yearly basis
- No current market exists due to the technical issues with use as a biofuel
- Harvest occurs at the same time of year resulting in a glut in the market or the need to store and manage a harvested crop

### *What do landowners need to consider before planting Hybrid Poplar?*

While there is renewed excitement regarding the use of Hybrid Poplar as a biomass fuel, landowners should give careful consideration to several factors before converting their land to a plantation.

### **Site appropriateness**

Hybrid poplars grow well on various soils, but they attain best growth on deep, fertile, alluvial soils that have adequate moisture with capacity to hold it. Agricultural lands not currently suited or used for cultivated crops, such as in grass for hay or pasture are fine. Quality cropland also can be used. Methods are available to eliminate stumps and return fields to agriculture, if necessary. High pH will reduce their growth and may kill them.<sup>6</sup>

Landowners should consider the distance of their land from potential end users, and what role transportation of crops will play.

### **Land preparation and maintenance**

The work involved in adequately preparing land for hybrid poplar is extensive. Don Rice, regional managing director for GreenWood, which grows about 35,000 acres of high-yield, fast-growing poplar, says, "It's not something you can just put in the ground, walk away from and come back in a couple of years to harvest. It requires all of the labor intensity of any crop."<sup>7</sup> Landowners should weigh the benefits of producing traditional crops versus producing hybrid poplar for biomass fuel.

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<sup>6</sup> Segal Ranch Hybrid Poplars. To read full webpage: [http://hybridpoplar.com/home/sr1/growing\\_main.html#0](http://hybridpoplar.com/home/sr1/growing_main.html#0)

<sup>7</sup> Agripulse. To read full article: <http://www.agri-pulse.com/Hybrid-poplar-spotlight-09-03-2013.asp>

## **Costs**

The investment for hybrid poplar plantations is front-end loaded. Costs associated with preparing the land, planting, maintaining, and harvesting will need to be incurred before any revenue is realized. Its ten-year growing cycle makes hybrid poplar a long-term investment. Increases in stumpage prices may make the return worth waiting for. Stumpage prices for native Aspen has increased from \$4 per cord in 1986 to \$28 per cord in 2001. Although the escalation of prices is not expected to continue at that rate indefinitely, it is estimated that the stumpage price could range between \$35 and \$50 per cord between 2008 and 2020. With a yield of 3-5 cords/acre/year, producers could expect \$1050 to \$2500 per acre in a ten year period.<sup>8</sup>

## **Marketability**

While there are no guarantees in life, the outlook for hybrid poplar trees in the region is good. Current markets for Hybrid Poplar in the Upper Peninsula include woody biomass fuel and paper and sawmills. Federal mandates for increased percentages of energy to come from renewable resources may create additional markets. Additional information on marketability can be found in the Markets section of this document and in the U.P Biofuels Cooperative Strategy.<sup>9</sup>

## **Law and Regulations**

There are numerous federal and state laws that may govern landowner actions including those regarding the use of pesticides, permitting, and activities effecting water bodies. Refer to Appendices B and C for more information.

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<sup>8</sup> 2003. Hybrid Poplar Handbook. Minnesota Department of Natural Resources, Division of Forestry and General Andrews Nursery.

<sup>9</sup> Woods, Roger. 2013 October. U.P. Biofuels Cooperative Strategy. Houghton, MI: Michigan Technological University. 23 p.

## DEVELOPING A HYBRID POPLAR FOREST MANAGEMENT PLAN

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This sample management plan is designed to give you a tool for effectively managing your property by giving consideration to all the uses you have or are planning to have for your property. This plan is a place to start and can be easily amended or adapted as conditions or interests change. Contacting a resource professional to discuss your options for specific interests is highly recommended.

### *What are your property goals?*

#### **Overall Goals:**

Describe your goals for your property:

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#### **Specific Goals:**

Check off the specific goals that you would like to achieve from your property and describe them further as stated:

Recreation

If yes, list the type of recreational activities (i.e. hunting, trapping, fishing, trails, wildlife viewing) and the wildlife species or type of trail involved:

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Aesthetics

If yes, list the specific aesthetic concerns:

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Water Quality

If yes, check the specific type(s) of water bodies:

- River/stream
  - Man-made ponds
  - Vernal ponds
  - Wetlands
  - Springs/wells
  - Other (please list):
- 

Forest Management

If yes, check the specific type(s) of forest management:

- Natural Forest Management
  - Plantation – Native Forest
  - Plantation – Hybrid Poplar
  - Other (please list):
- 

### *Considering Property Resources*

#### **Water**

Check any of the following that are present on the site:

- Streams/rivers
- Vernal ponds
- Lakes
- Wetlands

If any were selected, describe the measures that will be taken to protect these features:

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#### **Topography/Terrain**

Steepness

Percent of slope: \_\_\_\_\_

Length of slope (ft): \_\_\_\_\_

Describe equipment limitations due to steepness:

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Terrain

Rocky soils

Wet soils

If yes, describe the measures that will be taken to protect these features:

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**Historic/Archaeological Features**

Please indicate if any of the following are found on site:

Registered historic sites:  Yes  No

Registered archaeological sites:  Yes  No

If either of these exist on the planting site or nearby, please describe the measures that will be taken to protect these features:

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**Current Cover**

Site preparation is a very important step in the planting process. The requirements of the prep work are dependent on the different features on site, including existing cover. Please check the following that apply to existing cover:

Scattered trees with brush and grass

Brush and shrubs

Invasive

Grass herbaceous cover

*Density of cover*

Heavy

Medium

Scattered

Describe what will be done to address the current cover to prepare the site for planting and when:

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**Wildlife and Habitat**

Are there any threatened or endangered species on site?

Yes  No

If yes, name the species and describe the measures that will be taken to protect them:

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Are there any existing habitats to be protected (i.e. patches of heavy brush, mast/fruit trees)?

Yes     No

If yes, describe the habitat(s) and describe the measures that will be taken to protect it:

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Will any new habitats need to be established (i.e. plant thermal cover, mast/fruit trees, food plots)?

Yes     No

If yes, please describe the habitat(s) to be established and describe how and when they will be established:

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## MANAGEMENT STRATEGY

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### *Cost of Materials<sup>10</sup>*

#### **Expenses**

In order to establish a planting of hybrid poplars, the landowner will incur costs associated within the establishment and maintenance of the crop. Initially, the land will need to be prepped by clearing any existing trees, shrubs, and larger vegetation. The land will then need to be plowed and herbicide applied to kill and control weeds. The cuttings will need to be purchased and planted either manually or using tree planting equipment. Cuttings can cost between \$0.12 and \$0.20 each.

After initial establishment, the landowner will need to apply herbicide again at the beginning of the second year to continue to control weeds and other native grasses. After the third year, an application of fertilizer will occur. The final expense will come at the end of the growing cycle in year 10 when the trees will be harvested.

Landowner surveys conducted in 2012 indicated that there is interest in forming and joining a cooperative which could reduce the costs of planting and maintaining Hybrid Poplar plantations.

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<sup>10</sup> Woods, Roger. 2013 October. U.P. Biofuels Cooperative Strategy. Houghton, MI: Michigan Technological University. 23 p.

## Revenues

The revenue for the biomass is realized at the end of the ten-year growing cycle. This long-term return has been an issue for many of the landowners that have had their land assessed.

Following is a summary of expenses and revenues based on assumed costs.

Expenses (per acre)	Year									
	1	2	3	4	5	6	7	8	9	10
Machine and Planting										
Planting	\$121									
Herbicide	\$10	\$10								
Site Prep	\$25									
Fertilizer				\$50						
Harvest										\$385
Materials and Supplies										
Seedlings	\$145.20									
Herbicide	\$10	\$15								
Fertilizer				\$10						
<b>Total</b>	<b>\$311.20</b>	<b>\$25</b>	<b>\$0</b>	<b>\$60</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$385</b>
<b>REVENUES</b>		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	<b>\$900</b>

## Equipment<sup>11</sup>

Trees can be planted by hand or machine, which will determine the equipment needed.

### Hand planting

There are two general methods of hand planting. One of these is the hole method. This method usually results in a high rate of survival, but it is slow and is not practical for planting large numbers of trees. Under this method, the only equipment needed would be a shovel, mattock, and/or grub hoe. The slit or bar method is preferred when a large number of trees are being planted because it is faster. Under the slit/bar method, a spade, planting bar, and/or hoedad would be needed. To hire planters, the cost per planter, per tree is around \$0.08 - \$0.25, according to the Canadian Tree Planters<sup>12</sup>.

### Tree planting machines

There are many designs for tree-planting machines, but generally they have a coulter that breaks through the soil surface, a V-shaped blade that opens a trench into which the operator places seedlings, and packing wheels that firm the soil around the seedlings. Some newer planting machines have spray attachments for applying herbicides for grass and weed control.

<sup>11</sup> University of Minnesota. 2013 April. My Minnesota Woods, Woodland Care and Management. <http://www.myminnesotawoods.umn.edu/2007/04/planting-trees/>.

<sup>12</sup> Tree-Planter.com. Canada. The Basics of Tree Planting. [http://www.tree-planter.com/?navigation\\_id=89](http://www.tree-planter.com/?navigation_id=89).

Tree-planting machines work best where terrain is fairly level and the site has been cleared of stumps and logging debris. A three-person crew using a tree-planting machine can plant about 10,000 trees in an eight-hour day.

To try and get an idea of how much this would cost to rent this equipment, Marinette County, WI offers a rental program for tree planters. Their rate is \$10 per 1,000 trees for the first 10,000, and then \$8 per 1,000 after this. There is a minimum charge of \$30, as well as a planting minimum of 3,000 trees (there are exceptions that go as low as 1,000 trees depending on the planter's availability). They also offer two planters that can be pulled by the renter's own tractor to plant the seedlings (tractor should be around 30 hp). One of these planters can scrape off sod (heavy duty) while the other does not (medium duty). In order to transport the tree planter, it is recommended to have a full-size truck with a 2" ball hitch. Since the machine weighs 3,000 pounds, it must be towed as a "Slow Moving Vehicle" during the daylight at a maximum speed of 25 miles per hour<sup>13</sup>.

### *Timeline*<sup>1415</sup>

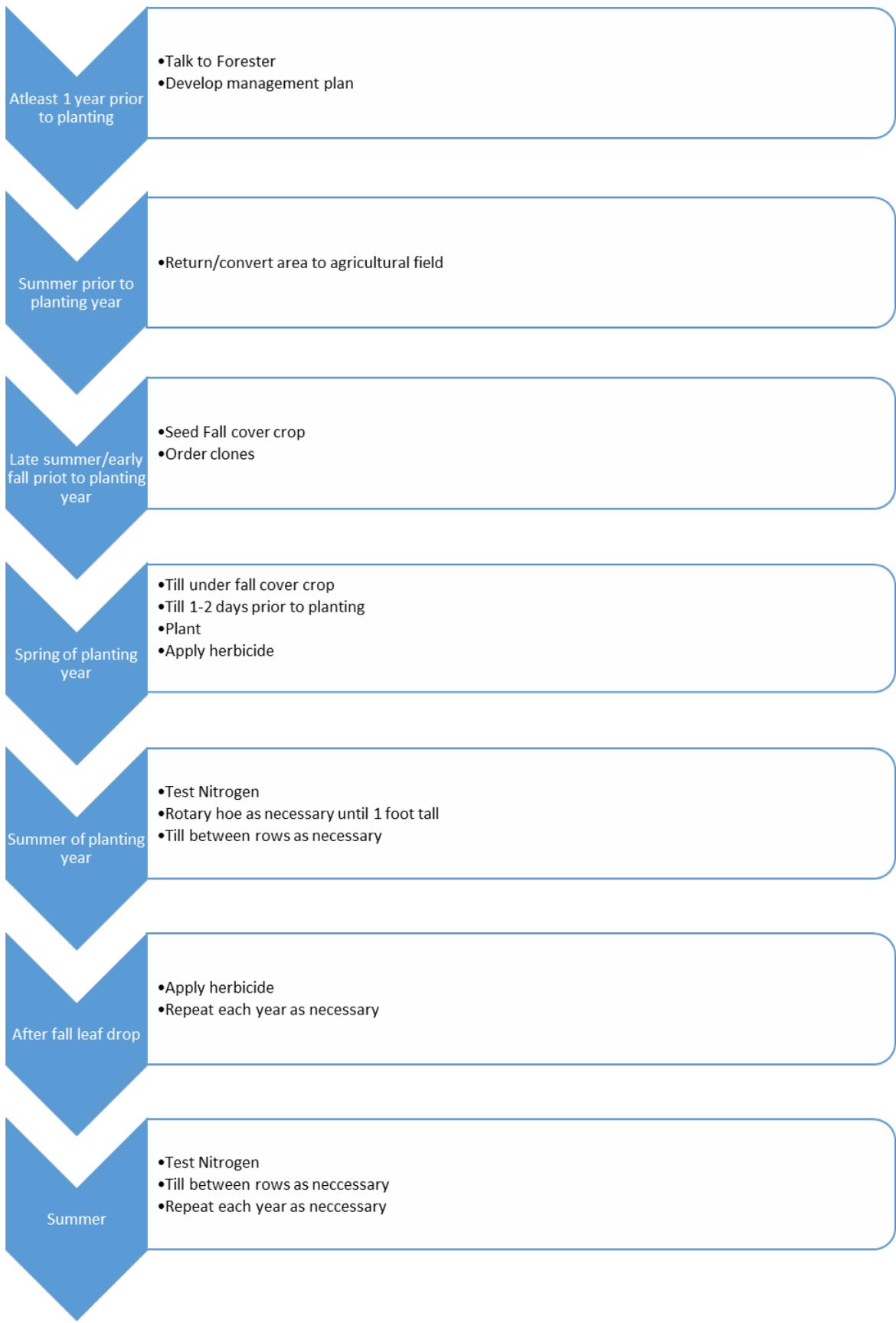
The following is a condensed timeline of the activities to take place during the planting process. The sections after this table describe each of the activities more thoroughly.

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<sup>13</sup> Marinette County, WI. 2013. Tree planter rental program.

<sup>14</sup> 2003. Hybrid Poplar Handbook. Minnesota Department of Natural Resources, Division of Forestry and General Andrews Nursery.

<sup>15</sup> Segal Ranch Hybrid Poplars. To read full webpage: [http://hybridpoplar.com/home/sr1/growing\\_main.html#0](http://hybridpoplar.com/home/sr1/growing_main.html#0)



## **Before Starting**

Before preparing the land, it is highly recommended to speak with a local forester. This forester will be able to provide suggestions about site selection including soil types and fertility, slope, as well as about tree spacing and type of planting stock, use of herbicides, and permitting requirements.

## **Site Selection**

Choose deep, fertile sandy-loam to clay-loam soils with pH levels between 5 and 7.5<sup>16</sup>, and those that have less than an 8% slope.

Select sites with a high water-holding capacity (greater than 10" in the top 5' of soil) or a shallow water table at 1' to 6'<sup>17</sup>, and that aren't prone to long term flooding.

Test soil fertility and fertilize according to corn recommendations. Often times, nitrogen is the most deficient element<sup>18</sup>.

## **Site Preparation<sup>19</sup>**

Site preparation refers to methods that establish desired tree species, control undesirable competing vegetation, and reduce organic debris and logging residue. Depending on the condition of the site, preparation efforts during the year prior to planting may be extensive.

The summer before the planting year, the site must be prepared and possibly returned to an agricultural field. The mechanical means, prescribed burning, and chemical treatments described below may be used to achieve this.

### ***Mechanical Preparations***

The following are recommended specifications for various mechanical means:

#### ***General Considerations:***

- Use mechanical site preparation techniques which cause the least disturbance to the site and still achieve the owner's objective.
- Recognize adequate RMZs.
- To minimize erosive impacts, mechanical treatment should be oriented along the contours of the site.
- Evaluate site for saturated soil conditions. Avoid operations during periods of saturated soil conditions that may cause rutting or accelerated soil erosion.

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<sup>16</sup> Tolsted, David N. 1988. Liming soils above pH 5.2 does not increase *Populus* growth. Res. Note NC-344. St. Paul, MN: U.S. Department of Agriculture. Forest Service, North Central Forest Experiment Station. 2 p.

<sup>17</sup> Hansen, Edward A. 1988. Irrigating short rotation intensive culture hybrid poplars. *Biomass*. 16(4): 237-250.

<sup>18</sup> Hansen, Edward A.; McLaughlin, Richard A.; Pope, Phillip E. 1988. Biomass and nitrogen dynamics of hybrid poplar on two different soils: implications for fertilization strategy. *Canadian Journal of Forest Research*. 18(2): 223-230.

<sup>19</sup> Sustainable Soil and Water Quality Practices on Forest Lands Guidelines. Michigan Department of Environmental Quality.

#### *Shearing and Raking:*

- Avoid dumping or concentrating residues from shearing and raking operations in flood plains or wetland areas. These residues should be deposited in stable areas so they do not interfere with drainage or cause erosion.
- Locate windrows and piles to minimize interference with natural drainage patterns.
- Locate windrows outside the RMZs.
- Give preference to locating windrows along contours to mitigate the effects of overland flow.
- Minimize incorporation of soil material into windrows and piles. Two examples of preferred practices are: a) shearing and raking under frozen soil conditions, and b) light raking which would only remove slash.
- Avoid shearing and raking operations on organic soils, except under frozen soil conditions.

#### *Disking (and other scarification treatments, such as chain drags and land breakers):*

- Limit to slopes of less than 10%, for all highly erodible soils.
- Follow the land contours with proper consideration given to equipment operator safety.
- Advantageous because it reduces soil compaction and incorporates organic matter.

#### *Patch and Row Scarification:*

- Use patch or row scarification as the preferred mechanical site preparation method for artificial regeneration where terrain or soil type necessitate minimum soil disturbance.
- Follow the contours of the land to maintain operator safety.

#### *Drum Chopping:*

- Limits soil exposure as residual trees and debris are knocked down.
- Maximum benefit comes from drum chopping up and down the slope so that blade depressions are on the contour, reducing the occurrence of channeled surface flow.

#### ***Prescribed Burning***

Using fire under controlled conditions can have benefits including: reduction of slash, reduction or elimination of undesired and competing vegetation encroachment, and creation of a seed bed or surface condition for natural or artificial regeneration of desired tree species. To achieve desired conditions and protect water quality, prescribed use of fire must be carefully planned and executed under strict weather and fuel conditions.

After the prescribed burn is complete and a significant rain event has occurred, inspect the fire lines on hilly or steep terrain where a stream or small body of water is close by to determine if these fire lines are eroding away and sediment is being transported down to a stream or water body. If this is occurring, install earth-berm water bars (probably only requiring a shovel) and during inspection, determine if any other areas of bare mineral soil (a result of the burn) are eroding into a water body.

If the prescribed burn is adjacent to an intermittent or perennial water body, the staff in charge should establish an RMZ, if it has not been done so already. The use of fire retardant foam at the boundary of the RMZ is permitted. Note that fire retardant foam is not toxic to aquatic life.

### **Chemical Treatment**

Use of chemicals to control vegetation (herbicide), insects (insecticide), small animals (rodenticide), and molds and fungus (fungicide) can be an efficient and effective means of site preparation. Herbicides have advantages over mechanical means because there is no soil disturbance and can be used where steep slopes prevent use of machinery. Herbicides can also be used in an existing stand for pre-harvest treatment. Rodenticides and fungicides can be applied to seeds or seedlings before or during planting to increase planting survival. However, water quality impacts must be a consideration in all use of chemicals to prevent their reaching ground water and surface water bodies.

The use of pesticides is regulated by federal and state laws. See appendix A for important information regarding their use. If you have any questions about pesticide application, please contact the Michigan Department of Agriculture, Pesticide and Plant Pest Management Division at 517-373-1087, or online at [www.michigan.gov/mda](http://www.michigan.gov/mda).

Once the site has been returned to an agricultural field, seed a fall cover crop such as Winter Rye the year prior to planting. In the spring of the planting year, till under the fall cover crop; generally Winter Rye is tilled under prior to flowering to most effectively fertilize the soil. A day or two prior to planting, field cultivate or till 10 inches deep.

### **Clonal Selection<sup>20</sup>**

Planting several different clones will reduce the risk of disease and sensitivity to attack from pests, and increase genetic diversity. Research disease-resistant clones that have been tested a number of years in the local area and use those that were proven effective<sup>21</sup>. Clones can be planted in small mosaics of multiple, isolated, but connected blocks. This will improve production by making planting easier, as well as provide wildlife habitat and corridors. This can be discussed with a local extension forester. Clones may have to be ordered the fall prior to planting to ensure availability.

### **Cutting Preparation**

Cuttings are sections of tree stems typically 10" long and 3/8" to 3/4" diameter with well-developed buds. They should be free from disease and bark damage<sup>22</sup>.

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<sup>20</sup> 2007. Best Management Practices Poplar Manual for Agroforestry Applications in Minnesota. University of Minnesota Extension.

<sup>21</sup> Ostry, Michael E.; Wilson, Louis F.; McNabb, Harold S.; Moore, Lincoln M. 1989. A guide to insect, disease and animal pests of poplars. Agric. Handb. 677. Washington, DC: U.S. Department of Agriculture, Forest Service. 118 p.

<sup>22</sup> Dickmann D.; Phipps, H.; Netzer, D. 1980. Cutting diameter influences early survival and growth of several *Populus* clones. Res. Note NC-261. St Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 4 p.

For short-term storage, cuttings can be kept sealed in plastic and store at 32°F - 40°F.

Warm up and soak the cuttings for 5-10 days prior to planting. Make small slits in the plastic bag and immerse  $\frac{3}{4}$  of the bag into water<sup>7</sup>. Keep cuttings in the shade with a temperature of 50°F - 70°F. Make sure the buds are pointing upwards.

Cuttings are ready for planting when the buds begin to elongate and show bright green around the bud scales. This is also before the roots begin to grow.

If cuttings cannot be planted due to weather, they can be held for weeks by placing them in cold storage at 34°F or by covering them with crushed ice<sup>23</sup>.

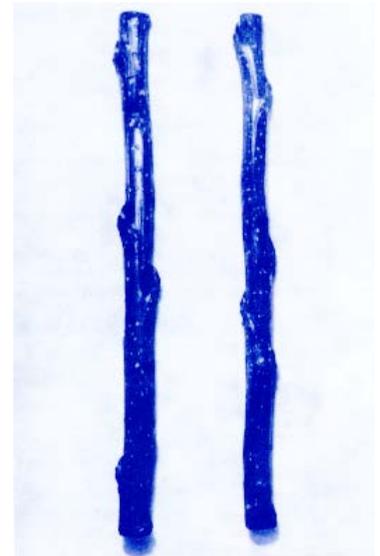
### Planting

Begin planting when soil temperatures reach 50°F, typically mid-April to early June. If soils are not moist during this time, postpone planting until after rain<sup>24</sup>.

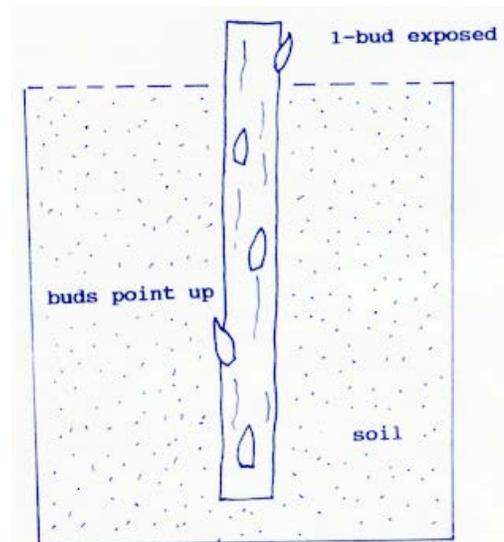
Keep cuttings wet while planting. Either hand plant or machine plant cuttings with no more than one bud above the soil's surface (approximately 1" or less of cutting exposed). Plant with buds pointing upwards<sup>25</sup>.

If hand planting choose the hole method or the slit/bar method. For the hand method, dig a hole with a shovel, mattock, or grub hoe. For the slit/bar method, insert a spade, planting bar, hoedad or similar tool into the soil and move it back and forth to form a V-shaped slit.

Remove the planting bar and reinsert it about three inches behind the cutting. Pull the bar back to firm soil around the cutting, then push forward on the bar to seal the top of the planting hole. Push soil into the second slit and press down firmly with your boot to seal the slit. Using this method, you can plant 1,000 to 3,000 cuttings per day, depending on your experience and the condition of the planting site. Be sure soil tilth is adequate for firm soil packing around the cutting.



*Cuttings ready for planting*



*Planted cutting*

<sup>23</sup> Phipps, Howard M.; Hansen, Edward A.; Fege, Anne S. 1983. Preplant soaking of dormant *Populus* hardwood cuttings. Res. Pap. NC-241. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 8 p.

<sup>24</sup> Hansen, Edward A.; Phipps, Howard M. 1983. Effect of soil moisture tension and preplant treatments on early growth of hybrid *Populus* hardwood cuttings. Canadian Journal of Forest Research. 13: 458-464.

<sup>25</sup> Hansen, Edward, Tolsted, David; Tower, Matthew. 1991. Planting depth of hybrid poplar cuttings influences number of shoots. Res. Note NC-355. St Paul, MN: U.S. Department of Agriculture. Forest Service, North Central Forest Experiment Station. 4 p.

Generally, tree spacing will be recommended to be 8' x 8' all the way up to 10' x 10'. This will result in planting 700 to 400 trees per acre, respectively. Choosing a shorter spacing will lead to shorter rotation periods, but the distance between rows needs to be large enough to accommodate equipment.

### **First-Year Weed Control**

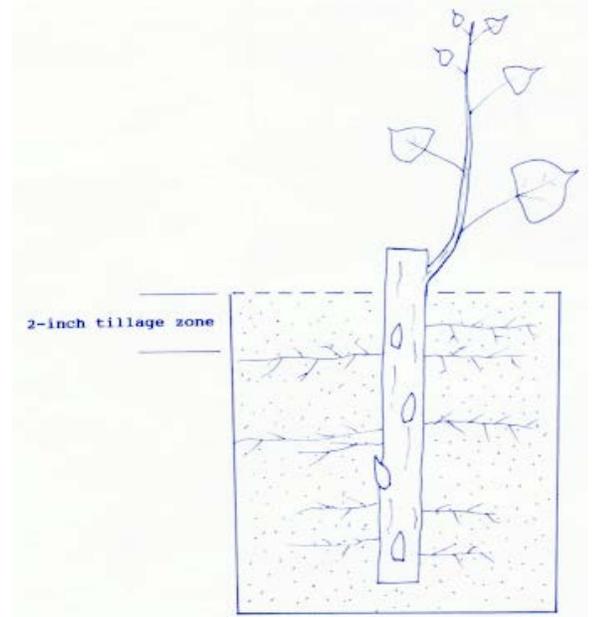
#### ***Growing Season***

Apply herbicide immediately after planting or when weed seed begins germinating at the latest<sup>26</sup>.

When herbicide effectiveness begins to decline (in 4 to 6 weeks), rotary hoe at 7- to 10-day intervals until trees are 1' tall or until hoe begins to cause top damage.

Till between rows as needed (about once a month) with a cultivator or 5' disc. Do not till deeper than about 2" because the trees have shallow roots.

If annual grasses invade the tree rows, apply an appropriate herbicide before grasses are 5" tall. Be careful, as some herbicides will damage growing trees.



*Growing cutting*

#### ***Dormant Season***

After fall leaf drop, or in the spring before June 1st, apply herbicides to control perennials, winter annuals, grasses, and spring germinants. A small tractor or all-terrain-vehicle (ATV) pulling a sprayer/trailer can be used.

#### ***Second and Third Year***

Delay the first tillage until herbicides no longer control weeds, then disc as necessary (2-3 times per summer).

Keep tillage shallow (less than 2") to minimize root pruning. Apply herbicide if grasses invade tree rows.

After fall leaf drop, or in the spring, apply herbicide as described above.

#### ***Fourth Year Weed Control***

If good cultural practices were used during the first three years, the trees should be shading out the weeds by the fourth year, reducing or eliminating the need for weed control. If some weed control is necessary, use practices prescribed for the second and third years.

<sup>26</sup> Hansen, Edward A.; Netzer, Daniel A. 1985. Weed control using herbicides in short-rotation intensively cultured poplar plantations. Res. Pap. NC-260. St. Paul. MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 6 p.

## **Fertilization**

Maintain leaf nitrogen content above three percent. Sample the uppermost fully expanded leaves on the terminal shoot in late June to determine nitrogen status. When samples are consistently lower than three percent, apply nitrogen as necessary (typically 50-150 lbs/acre.)

## **Irrigation**

Poplars need adequate moisture, especially in the first year, to develop a good root system, and to efficiently use fertilizers. Monitor soil moisture regularly. A variety of irrigation systems are available.

## **Protection**

The most effective protective measure is the clonal mosaic planting method described above combined with the maintenance of healthy trees. Even so, plantations can be susceptible to disease, insect problems, and animals browsing.

*Hypoxylon* canker is a disease without a known control. Initial stages of infection are characterized by sunken discolored areas on stems and branches, and advanced stages have blistered bark. Pruning branches can help prevent its spread.

There are a few insects that attack poplars and are a concern in Northern Michigan. The larvae of the Forest Tent Caterpillar can defoliate poplars; it can be controlled with an insecticide during the early larval stages.

Animal browsing causes the most damage during the first year of growth, and is usually contained to the edges of larger plantings. Control measures can include animal removal through hunting and trapping, repellent, and fencing. Additionally, removal of all of the weeds at once, and maintenance of a weed-free border will reduce pests.

## **Pruning**

When Hybrid Poplar is grown for high value wood products rather than pulpwood or biomass fuel, removing the lower dying branches will produce a better product. In an established plantation, remove unwanted branches with shears during late spring or early summer leaving a short branch stub so that the tree will heal quickly.

## **Harvest**

Harvest the plantation when average annual growth begins to decline, which can be determined by a local forester. The typical life cycle of a Hybrid Poplar plantation grown for woody biomass fuel is about 10 years. Depending on the size of the plantation, tree size, and the goals of the landowner, there are a range of harvest options. Your local forester can provide you more information about specific



harvesting methods and contractors. Regardless of the method, Poplars should be cut low to the stump to increase harvest and encourage resprouting. Portions of the trees not removed from the site should be spread on the site to promote decomposition.

### **Post-Harvest Options**

The stumps of the harvested cutting can be killed with herbicide and the stand can be replanted with new, improved stock. Another option is to retain the plantation with coppice regrowth. A forester can help determine the most productive post-harvest option.

### ***Markets***

Utilizing hybrid poplar as a biomass boiler fuel has been a primary use that has been discussed. There are several biomass plants operational in the region and there is discussion of several others being built. Additional demand may arise with federal mandates for increased renewable energy use.

Because of the fast growth of hybrid poplar, there are issues with sawing this wood into lumber products, but it can be done if handled properly. This lumber would potentially have the same uses as Aspen lumber (pallet parts and furniture stock.) The fast growth can also cause some issues in the making of paper because of the amount of juvenile wood involved, but many pulp mills have utilized hybrid poplar as well.<sup>27</sup>

Any pressed board plant that uses Aspen could also use hybrid poplar. Although there may be some issues because of the fast growth, this seems to be less of a concern than it is with paper or lumber production.

Pellet plants that utilize Aspen could also use hybrid poplar, either for a heating fuel or animal bedding pellet.

Plants that utilize Aspen for shavings or chips for animal bedding could also utilize hybrid poplar.

Creating biofuel (ethanol or bio-diesel) is a possibility for most tree species, although there aren't any plants currently in production in the Upper Great Lakes region, there is constant discussion about these products and 10 years from now this market may be very viable.

### **Specific Markets**

Sawmills – Any sawmill that currently saw Aspen could experiment with hybrid poplar to see if it would be a species they would be interested in.

Pulp/Paper Mill – PCA in Tomahawk, WI would be the closest Aspen-using mill.

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<sup>27</sup> The Forestry Source. (2009, July). *A Forest in the Desert: Hybrid Poplar Plantation Feeds NewMill*. Society of American Foresters.

Pressed Board (OSB) Plant – Louisiana Pacific in Sagola, MI would be the closest plant of this type.

Pellet Plant – The Superior Filer Plant in Niagara, WI would be the closed pellet plant, but in 10 years there may be other closer plants.

Animal Bedding – The NEPCO plant in Iron River, MI is the closest animal bedding plant with Aspen being a primary species.

Bio-Fuel – In 10 years it is possible that this could be a viable market. The Futurewood mill in Park Falls, WI has experimented with these products, but it is not currently in production.

Bio-mass Fuel – Currently the Warden plant in L'Anse, MI and Exel Energy in Ashland, WI would be the closest markets for this product, but the possibility of closer plants existing in 10 years is very strong. In addition, smaller boiler systems like those found at the Ontonagon School, the Calumet school, the North Dickinson school (Felch, MI), and at the Pinecrest Nursing Home (Powers, MI) could become operational in or nearer to Ontonagon County.

## APPENDICES

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### *APPENDIX A: Pesticide Use*

Potential water quality impact varies widely from one chemical to another and depends primarily on the: a) chemical's mobility, b) chemical's persistence, c) accuracy of the chemical's placement, and d) orientation of site to streams. Water quality can be protected by knowledge of the chemical being used and adherence to the manufacturer's specification and directions.

The chemical's label contains information regarding the safety of the applicator, species for which the chemical is registered, the pesticide rate or concentration, appropriate weather conditions for application, environmental impact and proper container disposal. Material Safety Data Sheets providing toxicological data are available from a chemical's manufacturer.

The basic federal law regulating pesticides and their use is the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). The Michigan Pesticide Control Act further regulates use, handling and application of pesticides. Additional laws pertaining to pesticide uses, transport and application exist.

All pesticides are classified for either "general" or "restricted" use. Restricted pesticides may be used only under supervision of certified applicators. Pesticide users need to be familiar with the laws and regulations pertaining to certification and proper use of pesticides.

Follow directions and heed all precautions on the label. Store pesticides in original containers in secured areas, out of reach of children and animals, and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment, as specified on the container/label.

Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicides from equipment, do not use the same equipment for insecticides or fungicides that you use for herbicides.

The use of returnable pesticide containers is recommended. Otherwise, dispose of empty pesticide containers promptly, in a landfill licensed to accept toxic materials. Special precautions should be taken around RMZs.

Portions of this appendix are an excerpt of the Sustainable Soil and Water Quality Practices on Forest Lands Guidelines.

### *Appendix B: Working within the laws governing nonpoint source pollution*

Forestry BMPs are practical and cost effective methods that are specifically designed to help protect the State's aquatic resources by minimizing the effect of nonpoint source (NPS) pollution caused by human activities on the landscape. The NPS pollution is one of the leading causes of water pollution and aquatic ecosystem degradation in the nation.

The NPS pollution comes from a wide variety of diffuse sources including atmospheric deposition, agriculture, urban storm water runoff, mine drainage, land development, road building and numerous other land use activities. In the forested landscape, rainfall or snowmelt runoff moving over and through the ground can carry natural and man-made pollutants toward water sources eventually depositing them into lakes, rivers, wetlands, coastal waters, or underground aquifers. Examples of these pollutants include excess fertilizers and pesticides from silvicultural activities and sediment runoff from harvest sites, skid trails, road building, bridge or culvert installation and other land altering activities.

There are a number of state and federal statutes that relate to Michigan aquatic resource protection including the protection of ponds, inland lakes, the Great Lakes and intermittent and perennial streams. In Michigan, Part 31 of the Natural Resources and Environmental Act, 1994 PA 451, as amended (NREPA), addresses direct or indirect discharges that impact water quality, wildlife, fish, aquatic life and plants.

Permits are required in a number of situations such as crossing streams and wetlands or building haul roads. These state and/or local permits help ensure proper engineering design and environmental protection. If you have questions regarding specific permit requirements, please contact the DEQ Environmental Assistance Center at 800-662-9278, or the local district DEQ Service Center (Note that a storm water permit is not required for mobile logging operations).

Failure to secure the necessary permits while engaged in logging, road building, and/or crossing streams activities is against the law. Violations could lead to enforcement actions and the possibility of fines of up to \$25,000 per day.

This appendix is an excerpt of the Sustainable Soil and Water Quality Practices on Forest Lands Guidelines. These sections are directly applicable to potential hybrid poplar planting.

### *Appendix C: List of applicable laws in Michigan*

#### **Part 17, Michigan Environmental Protection Act, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA).**

This Act provides for the protection of air, water, and other natural resources, and the public trust associated with those resources. It provides the right to any person to bring an action against another person, agency, corporation, and political subdivision for conduct that may pollute, impair or destroy air, water, or other natural resources.

#### **Part 31, (Section 3108) Water Resource Protection (Floodplain Regulatory Authority), of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA).**

A Part 31 permit (Section 3108) is required for any occupation, construction, filling, or grade change within the 100-year floodplain of a river, stream, drain, or lake. Bridges and culverts are considered an occupation of the floodplain, as are activities that involve storage of materials in the floodplain. A 100-year flood has a 1% chance of occurring or being exceeded in any given year. These activities are regulated by a permit system with the purpose of ensuring that the channels and floodways are kept clear and uninhabited and that structures placed outside the floodway are properly protected from flood damage. The floodway includes the stream channel and that portion of the floodplain that is required to convey the flow of floodwater. Structures that are placed outside of the floodway portion of the floodplain must be properly protected from flood damage. This can be accomplished by elevating structures above the 100-year floodplain elevation or by designing the structures to be water tight without human intervention.

#### **Part 31, (Section 3109) Water Resource Protection (Discharge into state waters), of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA).**

Section 3109 of Part 31 is the statute used in the State of Michigan to address direct or indirect discharges of a substance that is or may become injurious to any of the following: a) public health, safety, or welfare, b) waters used for domestic, commercial, industrial, recreational or other uses, c) value and utility of riparian lands, d) livestock, wild animals, birds, fish aquatic life, or plants or to their growth and propagation, and the value of fish or game. Pursuant to the Part 31 statute, specific rules have been promulgated to address pollutants or substances such as excess sediment that can become injurious to waters of the State and aquatic life and its productivity.

#### **Part 91, Soil Erosion and Sedimentation Control (SESC), of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA).**

The purpose of Part 91 is to prevent soil erosion and to protect the waters of the State from sedimentation. A permit is required for any earth change that disturbs one or more acres of land OR that is within 500 feet of a lake or stream. Plowing and tilling for crop production and integral activities associated with logging and mining do not require permits. Access roads leading to or from a logging area, and ancillary and support activities associated with logging and mining, are subject to permits. A SESC permit is obtained by contacting your local county or

municipal enforcing agency, CEA or MEA. For more information on the SESC program, please visit [www.mi.gov/deqland](http://www.mi.gov/deqland) and select "Soil Erosion and Sedimentation Control."

**Whether a permit is required or not, the landowner is responsible for preventing off-site sedimentation.** Activities that result in sedimentation to the waters of the State are a violation of Part 91 and are subject to enforcement actions by either the County Enforcing Agency or the State of Michigan. The counties are primarily responsible for issuing Part 91 permits. Prior to obtaining a permit, the landowner, or his/her designated agent, must submit an application and comprehensive soil erosion and sedimentation control plan to the appropriate county agency.

**Part 301, Inland Lakes and Streams, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA).**

The intent of the Inland Lake and Stream Protection Program is to protect the integrity of the land/water interface, the correlative rights of other riparian owners, and public trust in the inland waters of the State. Crossing a permanent or intermittent stream while skidding forest products or transporting them to the mill requires a Part 301 permit.

Road and pedestrian crossings, as well as utility crossings, that disturb land below the ordinary high water mark, are examples of common projects that require a Part 301 permit. A storm water outfall, with or without stream bank or streambed protection (riprap), stream relocations and enclosures are also examples of projects requiring a permit.

**Part 303, Wetlands Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA).**

Part 303 defines a wetland as "land characterized by the presence of water at a frequency and duration sufficient to support, and that under normal circumstances does support, wetland vegetation, or aquatic life, and is commonly referred to as a bog, swamp, or marsh."

The following construction activities are prohibited in wetlands, unless a Part 303 permit has been obtained from the DEQ:

- Deposit or permit the placing of fill material in a wetland.
- Dredge, remove, or permit the removal of soil or minerals from a wetland.
- Construct, operate, or maintain any use or development from a wetland.
- Drain surface water from a wetland.

Regulated wetlands are defined in Part 303 and associated administrative rules. However, silvicultural and timber harvesting activities, such as the building of roads for wood transport, are exempt from obtaining a Part 303 permit, as long as adverse effects on the wetland are minimized and the roads are built solely for logging or forestry purposes.

**Part 305, Natural Rivers Act, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA).**

This statute regulates all development and land uses, including timber harvesting and stream crossings, on both public and private lands, that are within 400 feet of a designated stream.

Part 305 requires DNR approval of plans for the location and construction of any utility or publicly provided facility, including roads, bridges and culverts, within a designated Natural River Area. Each designated river system is managed according to a long-range management plan.

This plan outlines the specific manner in which lands and water are to be managed to protect the unique river values of a designated Natural River system. Both mainstream and tributaries are regulated under Part 305.

**Part 323, Shorelands Protection and Management, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA).**

This program provides for the designation and proper management of environmental areas, high-risk erosion areas and flood risk areas along the Great Lakes shoreline. These areas include coastal wetlands and the adjacent uplands that provide habitat and nursery for fish and wildlife. A Part 323 permit is required for certain activities in a designated environmental area.

**Part 353, Sand Dunes Protection and Management, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA).**

The designated critical dune areas along the Great Lakes shoreline are areas where the most unique and fragile sand dunes are found. This program minimizes the impact of development on these critical dune areas. A permit is required for all proposed new uses in designated critical dune areas mapped in the "Atlas of Critical Dune Areas", prepared by the DEQ.

**Part 365, Endangered Species Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA).**

This statute protects threatened and endangered species from being taken or harmed during project development activities, unless a permit is issued by the DNR. Where threatened and endangered species are thought to exist, the landowner or responsible party is required to request an environmental review by the DNR to determine whether or not threatened or endangered species may be impacted by planned activities.

**Part 515, Forest Protection and Forest Fires Act, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA).**

This establishes the machinery to protect the forest from fires. It applies to all forest land; timbered, potential timber producing, cutover or burned timber land or grasslands, not including farmland. It requires a permit for burning on or adjacent to forestland, except for domestic purposes, and when the ground is snow covered.

**National Pollutant Discharge Elimination System (NPDES) – Michigan Environmental Protection Act, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA).**

A NPDES permit is required for fixed forestry activities such as permanent log storage areas maintained by paper mills or saw mills. Discharge to a storm sewer does not go to a municipal

treatment facility, and is considered a direct discharge. Discharge to a municipal treatment facility may require a permit from the municipality under the Industrial Pretreatment Program.

**Act 676 of 2002, Right to Forest Act.**

An Act to provide for circumstances under which certain forestry operations shall not be found to be a public or private nuisance; to provide for certain forestry management practices; to provide for certain powers and duties for certain state agencies and departments; and to provide remedies.

To read the full Sustainable Soil and Water Quality Practices on Forest Lands Guidelines, please visit <http://www.michigan.gov/dnr>.

## *Appendix D: Resources*

**The Michigan Department of Natural Resources (DNR), Division of Forestry** provides resource information, technical planning assistance, funding programs and general forestry administration.

Gary Willis, Service Forester  
MDNR Baraga OSC  
427 US 41 N  
Baraga, MI 49908  
(906) 353-6651  
[willisg2@michigan.gov](mailto:willisg2@michigan.gov)

**Soil and Water Conservation Districts (SWCDs)** help the public locate resource information and programs, technical assistance for woodland owners, and funding for various woodland management activities.

Celie L. Borndal, FAP District Forester  
2 South Sixth Street - Suite 15  
Crystal Falls, MI 49920  
Office: 906-875-3765, Cell: 906-235-5831  
[celie.borndal@macd.org](mailto:celie.borndal@macd.org)

**Michigan Technological University Professor Robert Froese** has done extensive research on Hybrid Poplar planting and its use as an energy crop.

Robert Froese  
Michigan Technological University  
1400 Townsend Drive  
Houghton, Michigan 49931 USA  
Tel: 1-800-WOODS-MI  
[froese@mtu.edu](mailto:froese@mtu.edu)

**Hramor Nursery, LLC in Manistee, MI** sells Hybrid Poplar cuttings to Upper Peninsula growers.

Hramor Nursery, LLC  
2267 Merkey Road  
Manistee, MI 49660  
Tel: 231-723-4846  
[www.hramornursery.com](http://www.hramornursery.com)

**Erickson Feed, Seed & Pet Supply** sells herbicides, pesticides, seed, and fertilizers to Upper Peninsula growers.

Erickson Feed, Seed & Pet Supply  
47926 Main Street  
Houghton, MI 49931  
Tel: 906-482-7071